FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Division of Water Resource Management, Bureau of Watershed Management

Southwest District • Tampa Bay Tributaries Basin

TMDL Report

Fecal and Total Coliform TMDL for Baker Creek (WBID 1522C)

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Web sites

Florida Department of Environmental Protection, Bureau of Watershed Management

TMDL Program

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Identification of Impaired Surface Waters Rule

http://www.dep.state.fl.us/water/tmdl/docs/AmendedIWR.pdf

STORET Program

http://www.dep.state.fl.us/water/storet/index.htm

2000 305(b) Report

http://www.dep.state.fl.us/water/305b/index.htm

Criteria for Surface Water Quality Classifications

http://www/dep.state.fl.us/legal/legaldocuments/rules/ruleslistnum.htm

Basin Status Report for the Hillsborough Basin

http://www.dep.state.fl.us/water/tmdl/stat_rep.htm

Water Quality Assessment Report for the Hillsborough Basin

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Allocation Technical Advisory Committee (ATAC) Report

http://www.dep.state.fl.us/water/tmdl/docs/Allocation.pdf

U.S. Environmental Protection Agency, National STORET Program

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Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for fecal and total coliform for Baker Creek in the Hillsborough River Basin. The stream was verified as impaired for fecal and total coliform, and was included on the Verified List of impaired waters for the Hillsborough Basin that was adopted by Secretarial Order in May of 2004. The TMDL establishes the allowable loadings to Baker Creek that would restore the waterbody so that it meets its applicable water quality criteria for fecal and total coliform.

1.2 Identification of Waterbody

Baker Creek is a third-order stream located in the north-central area of Hillsborough County (Figure 1.1). It flows in the southeast-to-northwest direction into Lake Thonotosassa and drains

a watershed area of about 27.4-square-miles (mi^2). The stream is about two miles long and is flanked by State Route 41 to the north and State Route 400 to the south. The nearest major urban center to Baker Creek is the City of Bradenton, located approximately nine miles to the south.

The watershed is part of the Gulf Coastal Lowland area, which has a relatively low relief and abundant existence of Karst features. Interaction of surface water with the ground water is frequent in this area. Additional information about the river's hydrology and geology are available in the Basin Status Report for the Group 1 Tampa Bay Basin (Florida Department of Environmental Protection [FDEP], 2001).

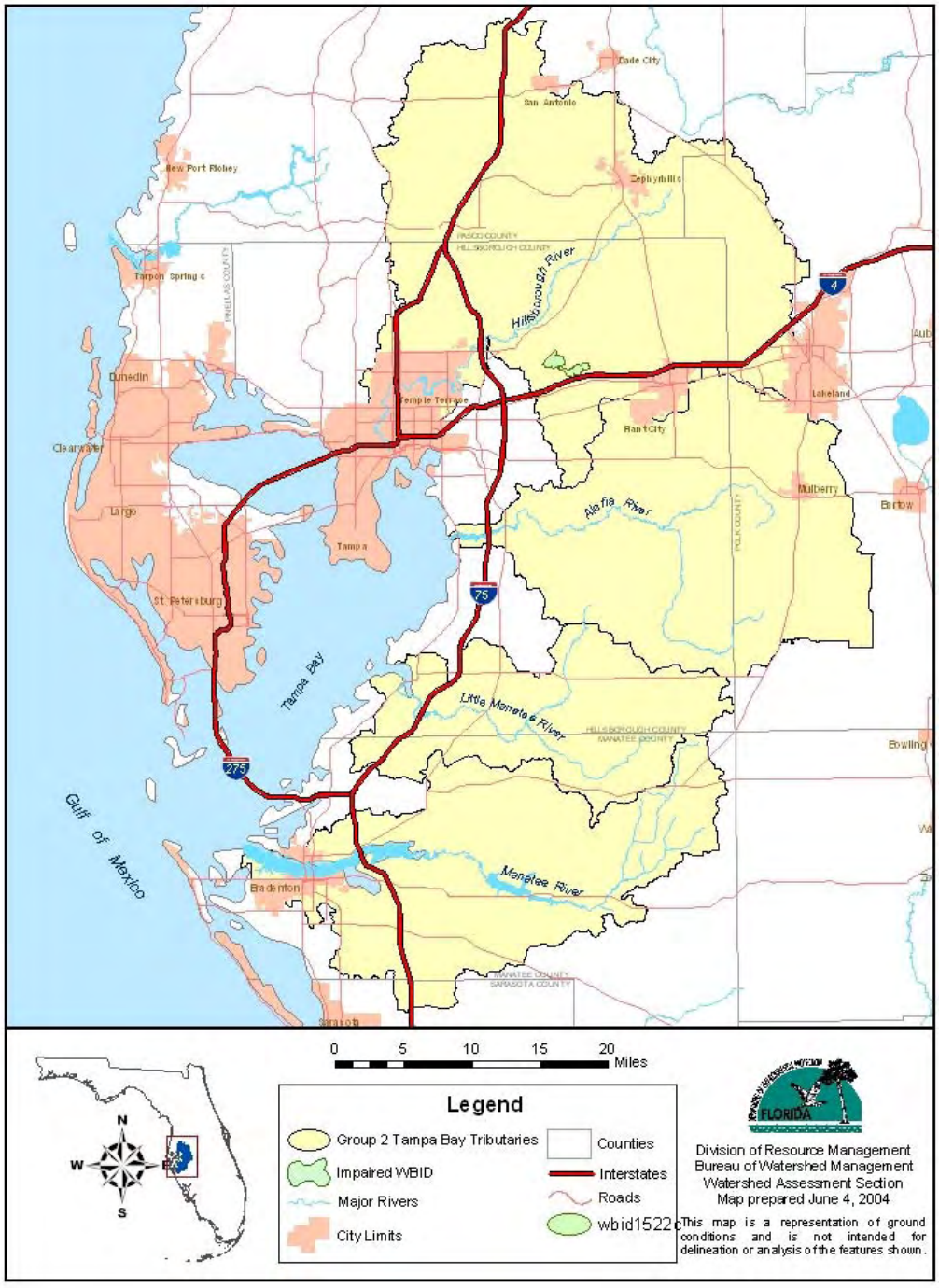
For assessment purposes, the Department has divided the Hillsborough River Basin (see Figure 1.2) into water assessment polygons with a unique **w**ater**b**ody **id**entification (WBID) number for each watershed or stream reach**,** and this TMDL addresses the WBID 1522C.

1.3 Background

This report was developed as part of the Florida Department of Environmental Protection's (Department) watershed management approach for restoring and protecting state waters and addressing TMDL Program requirements. The watershed approach, which is implemented using a cyclical management process that rotates through the state's fifty-two river basins over a five-year cycle, provides a framework for implementing the TMDL Program–related requirements of the 1972 federal Clean Water Act and the 1999 Florida Watershed Restoration Act (FWRA, Chapter 99-223, Laws of Florida).

A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and its designated uses. TMDLs are developed for waterbodies that are verified as not meeting their water quality standards. TMDLs provide important water quality restoration goals that will guide restoration activities.

Figure 1.1. DEP Southwest District Basin Groups. Hillsborough River in Group 2


Dade City
San Antonio
New Port Richey
Zephyrhills
Tarpon Springs
Hillsborough River
Dunedin
Temple Terrace
Plant City
Lakeland
Clearwater
Largo
Mulberry
Alafia River
Tampa
St. Petersburg
Tampa Bay
Little Manatee River
Gulf of Mexico
Bradenton
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0 5 10 15 20 Miles
N
W
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Legend
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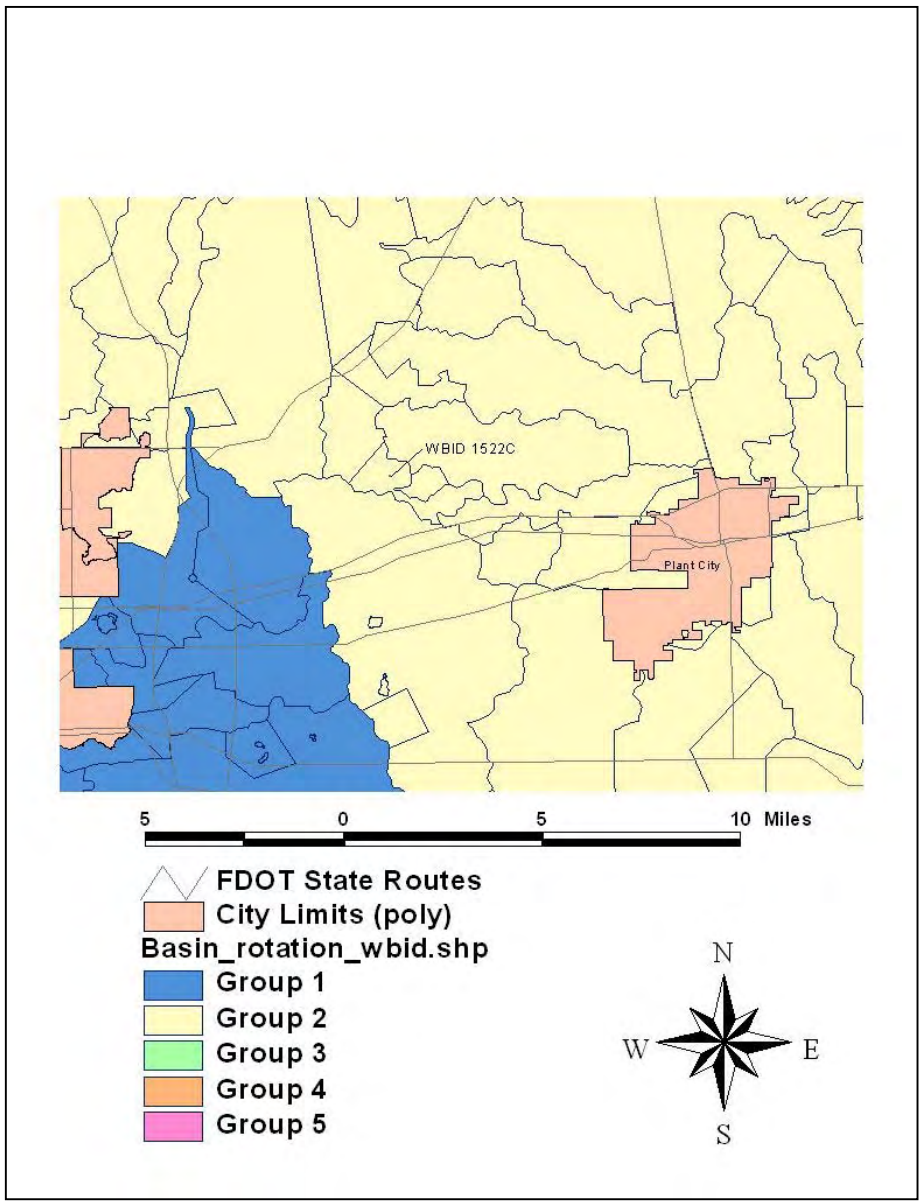
Impaired WBID
Major Rivers
City Limits
Counties
Interstates
Roads
wbid1522c
FLORIDA
Division of Resource Management
Bureau of Watershed Management
Watershed Assessment Section
Map prepared June 4, 2004
This map is a representation of ground conditions and is not intended for delineation or analysis of the features shown.

Figure 1.2. Location of Baker Creek in the Hillsborough River Basin



This TMDL Report will be followed by the development and implementation of a Basin Management Action Plan, or BMAP, to reduce the amount of fecal and total coliform that caused the verified impairment of Baker Creek. These activities will depend heavily on the

active participation of the Southwest Florida Water Management District (SWFWMD) Water Management District, local governments, businesses, and other stakeholders. The Department will work with these organizations and individuals to undertake or continue reductions in the discharge of pollutants and achieve the established TMDLs for impaired waterbodies.

Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act requires states to submit to the EPA a list of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant causing the identified impairment of the listed waters on a schedule. The Department has developed such lists, commonly referred to as 303(d) lists, since 1992. The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA (Subsection 403.067[4)] Florida Statutes [F.S.]), and the state's 303(d) list is amended annually to include basin updates.

Florida's 1998 303(d) list included 21 waterbodies in the Hillsborough River Basin. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rulemaking process, the Environmental Regulation Commission adopted the new methodology as Chapter 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in the Baker Creek watershed and has verified that the stream was impaired for fecal and total coliform bacteria (**Table 2.1)**. The impairment verification was based on the observation that 129 of 286 fecal coliform samples collected during the verified period (January 1, 1996 – June 30, 2003) exceeded the fecal coliform criterion, and111 out of 129 total coliform samples exceeded the total coliform criterion. The exceedances ranged from 401 MPN/100 ml to 3,200 MPN/100 ml for fecal coliform, and from 2,401 MPN/100 ml to 20,000 MPN/100 ml for total coliform. This TMDL represents a determination of the assimilative capacity of Baker Creek for both fecal and total coliform. Monitoring results of fecal coliform for the verified period are provided in Appendix B, and monitoring results of total coliform for the verified period are provided in Appendix C.

Table 2.1. Verified Impaired Segments in Baker Creek

WBID	Waterbody Segment	Parameters of Concern	Priority for TMDL Development	Projected Year for TMDL Development
1522C	BAKER CREEK	Fecal Coliform	HIGH	2003
1522C	BAKER CREEK	Total Coliform	HIGH	2003

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criteria Applicable to the TMDL

Florida's surface waters are protected for five designated use classifications, as follows:

Class I	**Potable water supplies**
Class II	**Shellfish propagation or harvesting**
Class III	**Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife**
Class IV	**Agricultural water supplies**
Class V	**Navigation, utility, and industrial use (there are no state waters currently in this class)**

Baker Creek is a Class III waterbody, with a designated use of recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. The Class III water quality criteria applicable to the impairment addressed by this TMDL are fecal and total coliform.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

Numeric criteria for bacterial quality are expressed in terms of fecal coliform bacteria and total coliform bacteria concentrations. The water quality criteria for protection of Class III waters, as established by Chapter 62-302, F.A.C., states the following:

> ***Fecal Coliform Bacteria:***
> *The most probable number (MPN) or membrane filter (MF) counts per 100 ml of fecal coliform bacteria shall not exceed a monthly average of 200, nor exceed 400 in 10 percent of the samples, nor exceed 800 on any one day.*
>
> ***Total Coliform Bacteria:***
> *The MPN per 100 ml shall be less than or equal to 1,000 as a monthly average nor exceed 1,000 in more than 20 percent of the samples examined during any month; and less than or equal to 2,400 at any time.*

For both parameters, the criteria state that monthly averages shall be expressed as geometric means based on a minimum of ten samples taken over a thirty-day period. During the development of load curves for the impaired streams (as described in subsequent sections), there were insufficient data (less than 10 samples in a given month) available to evaluate the geometric mean criterion for either fecal coliform or total coliform bacteria. Therefore, the criterion selected for the TMDLs was not to exceed 400 for fecal coliform, or 2400 for total coliform, as single sample maximums.

Chapter 4: ASSESSMENT OF SOURCES

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of the pollutant of concern to the watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either "point sources" or "nonpoint sources." Historically, the term point sources has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term "nonpoint sources" was used to describe intermittent, rainfall driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

However, the 1987 amendments to the Clean Water Act redefined certain nonpoint sources of pollution as point sources subject to regulation under the EPA's National Pollutant Discharge Elimination Program (NPDES). These nonpoint sources included certain urban stormwater discharges, including those from local government master drainage systems, construction sites over five acres, and a wide variety of industries (see **Appendix A** for background information on the federal and state stormwater programs).

To be consistent with Clean Water Act definitions, the term "point source" will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) and stormwater systems requiring an NPDES stormwater permit when allocating pollutant load reductions required by a TMDL (see Section 6.1). However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES stormwater discharges and non-NPDES stormwater discharges, and as such, this source assessment section does not make any distinction between the two types of stormwater.

4.2 Potential Sources of fecal and total coliform in the Baker Creek Watershed

4.2.1 Point Sources

There was one NPDES permitted wastewater treatment facility that discharged indirectly into Baker Creek. The Plant City Water Reclamation Facility, which has a design capacity of 2.68 MGD, used to discharge treated effluent through a discharge pipe to Pemberton Creek, a tributary to Baker Creek. However, the discharge was relocated to East Canal in the Blackwater Creek watershed in August 1997.

Municipal Separate Storm Sewer System Permittees

Within the Tampa Bay Basin, the stormwater collection systems owned and operated by Plant City, Hillsborough County, and the Florida Department of Transportation for Hillsborough County are covered by an NPDES municipal separate storm sewer system (MS4) permit, FLS000006. Hillsborough County is the lead co-permittee for the Baker Creek watershed. In October 2000, Hillsborough County drafted a watershed management plan involving berm construction, channel improvements, and structural upgrades for flood control and some water quality treatment. Other recommendations for the Baker Creek watershed included beginning a study to identify areas or sources that discharge pathogens, and beginning to provide treatment through the implementation of best management practices (BMPs) to reduce the loadings. The Hillsborough Planning and Growth Management Department is in the process of carrying out a septic tank study for the watershed that identifies the location of septic tanks, assesses their impacts on water quality, and recommends management techniques to improve their efficiency.

4.2.2 Land Uses and Nonpoint Sources

Because no major point sources were identified in the Baker Creek watershed, the primary loadings of fecal coliform to Baker Creek are generated from nonpoint sources in the basin. Nonpoint sources of coliform bacteria generally, but not always, involve accumulation of coliform bacteria on land surfaces and wash off as a result of storm events, and contribution from ground water caused by sources such as failed septic tanks and improper land application of domestic wastewater residual. Typical nonpoint sources of coliform bacteria include:

- Wildlife
- Agricultural animals
- Pets in residential area
- Onsite Sewer Treatment and Disposal Systems (septic tanks)
- Land application of domestic wastewater residual
- Urban development (outside of Phase I or II MS4 discharges)
- Leaking sewer lines

Land Uses

The spatial distribution and acreage of different land use categories were identified using the 1999 land use coverage (scale 1:40,000) contained in the Department's GIS library. Land use categories in the watershed were aggregated using the simplified Level 3 codes tabulated in **Table 4.1. Figure 4.1** shows the acreage of the principal land uses in the watershed.

The dominant land use category is the agricultural and primarily low and medium residential areas. The total area occupied by the residential land use category is about 228 acres and accounts for about 15.5% of the total watershed area. Another 61% of the watershed is claimed by agriculture and rangeland. The natural land use area, which includes upland forest, water, and wetland, accounts for about 20% of the total watershed area. Table 4.2 lists the area for

each land use category. A general impression is that the watershed is low density residential, which is most likely to have a septic tank system. Leakage from these systems could be a potential source of fecal and total coliform. Some of the open land areas are used as pasture or rangeland. Contribution from the livestock could be another important source of fecal and total coliform. In addition, wildlife contribution in some of the open land and swamp areas could also contribute to the high fecal and total coliform concentration in Baker Creek.

Figure 4.1 Land Use in the Baker Creek Watershed

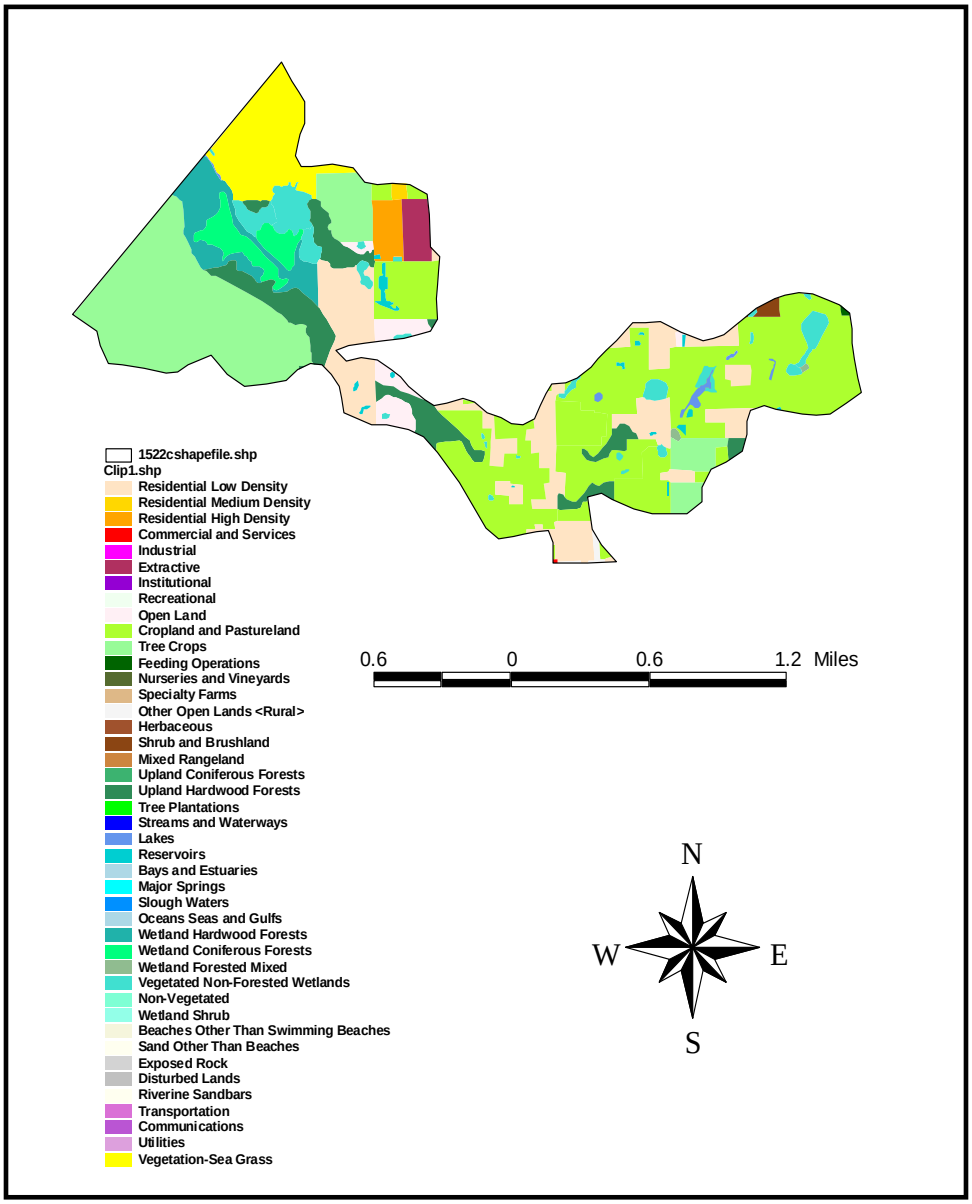


Table 4.1. Classification of Land Use Categories in the Baker Creek Watershed

Level 3 Land Use Code	Land Use Attribute	Acreage
1100	Residential Low Density < 2 Dwelling Units	204.6
1200	Residential Med Density 2-5 Dwelling Unit	2.9
1300	Residential High Density	20.4
1400	Commercial And Services	0.1
1600	Extractive	19.2
1900	Open Land	33.5
2100	Cropland And Pastureland	477.1
2140	Row Crops	96.6
2200	Tree Crops	323.6
2300	Feeding Operations	0.6
2600	Other Open Lands <rural>	2.4
3200	Shrub And Brushland	4.1
4340	Hardwood Conifer Mixed	106.5
5200	Lakes	5.5
5300	Reservoirs	8.2
6150	Stream And Lake Swamps (bottomland)	62.5
6210	Cypress	39.5
6300	Wetland Forested Mixed	1.6
6410	Freshwater Marshes	39.8
6430	Wet Prairies	22.4
6440	Emergent Aquatic Vegetation	1.9
	Total	1473.9

Population

According to the U.S Census Bureau, the population density in and around WBID 1522C in the year 2000 was at or less than 405 people per square mile. The Bureau reports that the total population in Hillsborough County, which includes (but is not exclusive to) WBID 1522C, for 2000 was 998,948 with 425,962 housing units. This places Hillsborough County among the highest in housing densities in Florida (U.S. Census Bureau Web site, 2004). However, most of the high housing density is located further west of WBID 1561 in the Tampa Bay and Saint Petersburg areas. WBID 1561 is primarily composed of medium density residential (16.8%), and only 28.39 percent of the total land use in WBID is dedicated to residences.

Septic Tanks

The following information was obtained from the state of Florida Department of Health website: http://www.doh.state.fl.us/environment/OSTDS/statistics/ostdsstatistics.htm. Data for septic tanks is based on the 1970-2001 census results, with year by year additions based on new septic tank construction. The data does not reflect septic tanks that have been removed.

Hillsborough County has a cumulative registry of 100,483 septic tanks. With 425,962 households in the county, this means that approximately 76 percent of the residences within the county are connected to wastewater treatment plants, with the rest (24 percent) utilizing septic tanks. While the percent of residences with septic tanks within the Baker Creek watershed cannot be determined by these county-wide statistics, it is assumed that the percent of residences with septic tanks is higher for the Baker Creek watershed than the percentage for Hillsborough County given the rural nature of the watershed.

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

The methodology used for this TMDL is the "load duration curve." Also known as the "Kansas Approach", because it was developed by the state of Kansas, this method has been well documented in the literature, with improved modifications used by EPA Region IV. Basically, the method relates the pollutant concentration to the flow of the stream to establish the existing loading capacity and the allowable pollutant load (TMDL) under a spectrum of flow conditions. It then determines the maximum allowable pollutant load and load reduction requirement based on the analysis of the critical flow conditions. Using this method, it takes four steps to develop the TMDL and establish the required load reduction:

1. Develop the flow duration curve
2. Develop the load duration curve for both the allowable load and existing loading
3. Define the critical conditions
4. Establish the needed load reduction by comparing the existing loading to the allowable load under critical conditions

5.1.1 Data Used in the Determination of the TMDL

Fecal coliform concentrations and flow measurements were required to estimate both the allowable pollutant load and existing loading. Figure 5.1 shows the locations of the water quality sites from which fecal and total coliform data were collected and the USGS gauging station from which the flow measurements were taken. The primary data collector of historical data is the SFWMD, which routinely sampled the site identified as STORET ID: 21FLHILL24030034 on a monthly basis from 1/23/91 through 12/09/98, and the site identified as STORET ID: 21FLHILL107 on a monthly basis from 1/1/99 through 12/24/02. The third site, STORET ID: 112WRD023205 was sampled in August and September of 1993 and 1994. Table 5.1 provides a brief statistical overview of the observed data at these sites.

Figure 5.1. Historical Monitoring Sites in Baker Creek WBID 1522C

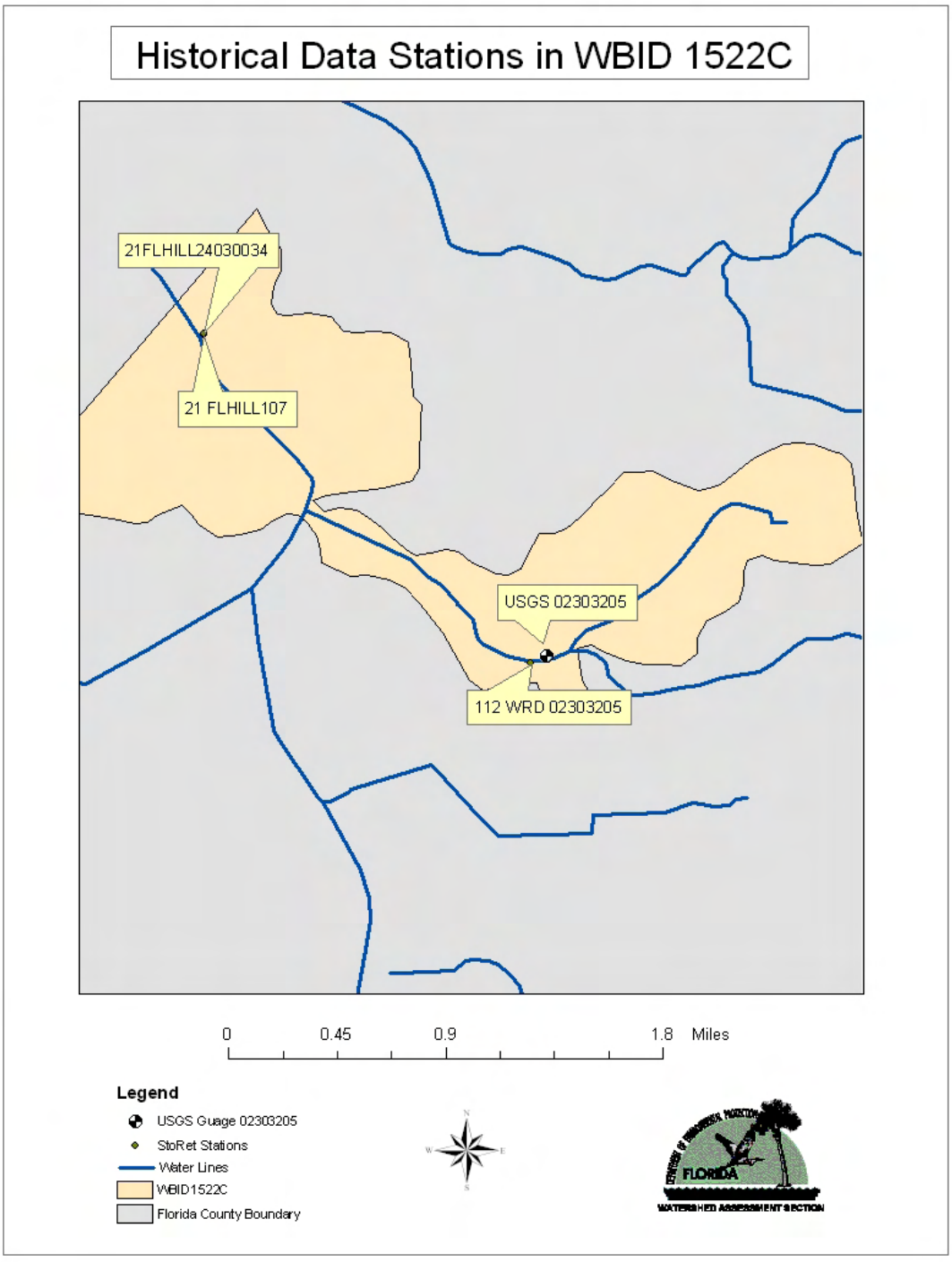


Table 5.1. Statistical Table of Observed Historical Data for Baker Creek WBID 1522C

Table 5.1. Summary of Fecal and Total Coliform in Baker Creek WBID 1522C

Storet Station ID	Parameter	Number of Observations	Minimum Concentration/ Counts	Maximum Concentration/ Counts
21FLHILL107	Fecal Coliform	82	20	5,800
	Total Coliform	31	200	16,800
21FLHILL24030034	Fecal Coliform	194	20	10,000
	Total Coliform	97	500	20,000
112WRD02303205	Fecal Coliform	5	72	166

5.1.2 TMDL Development Process

5.1.2.1 Develop the flow duration curve

The first step in the development of load duration curves is to create flow duration curves. A flow duration curve displays the cumulative frequency distribution of daily flow data over the period of record. The duration curve relates flow values measured at a monitoring station to the percent of time the flow values were equaled or exceeded. Flows are ranked from low, which are exceeded nearly 100 percent of the time, to high, which are exceeded less than 1 percent of the time.

Based on flow records from the USGS gage 02303205 located at Baker Creek at McIntosh Road, a flow duration curve was developed **(Figure 5.2).** Using the flows from this curve, load duration curves for Fecal and Total Coliform **(Figure 5.3 and Figure 5.4)** were calculated using the following equation:

Equation 1: **(observed flow) x (conversion factor) x (state criteria)**
= **([fecal coliform or total coliform]/day or daily load)**

The above equation yields the load duration curve or allowable load curve, which are the target lines in **Figures 5.3 and 5.4**. Fecal and Total Coliform observations were plotted, noting where the samples are in relation to the allowable load curve (above or below the curve). Those above the curve **(Figures 5.3 and 5.4)** are noted as exceedances to the state criterion and are indicated by a square.

Figure 5.2. Flow Duration Curve for USGS Gage 02303205

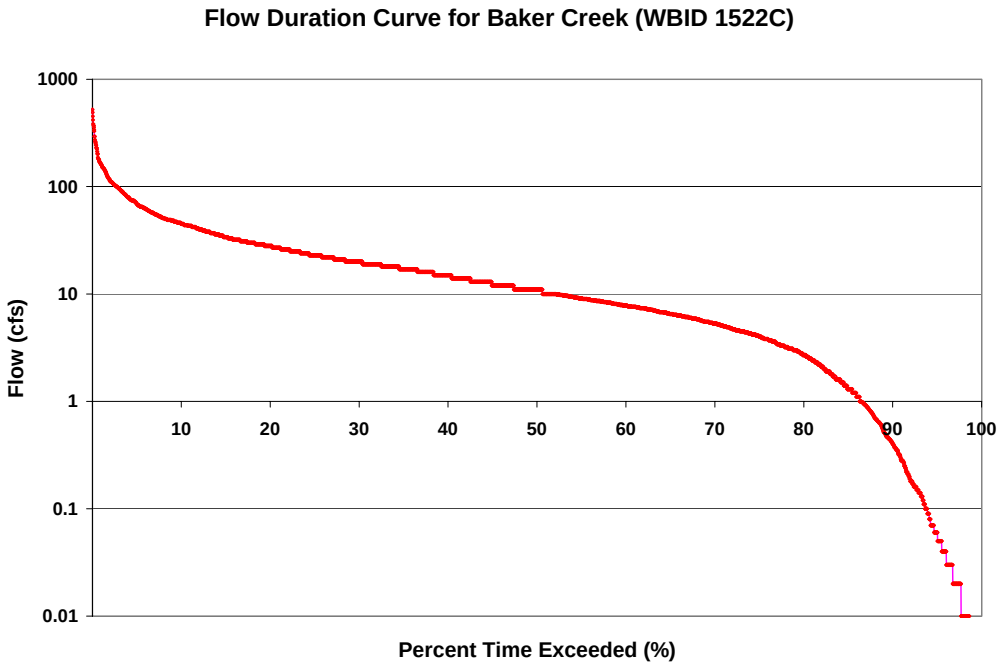


Figure 5.3. Load Duration Curve for Fecal Coliform in WBID 1522C

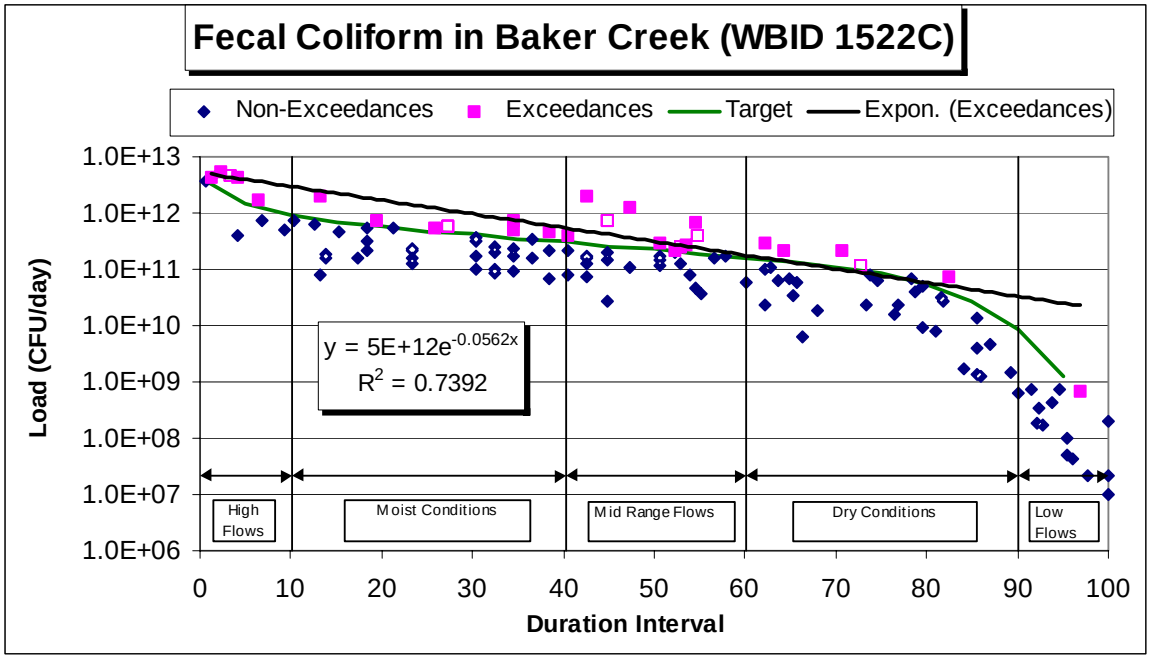
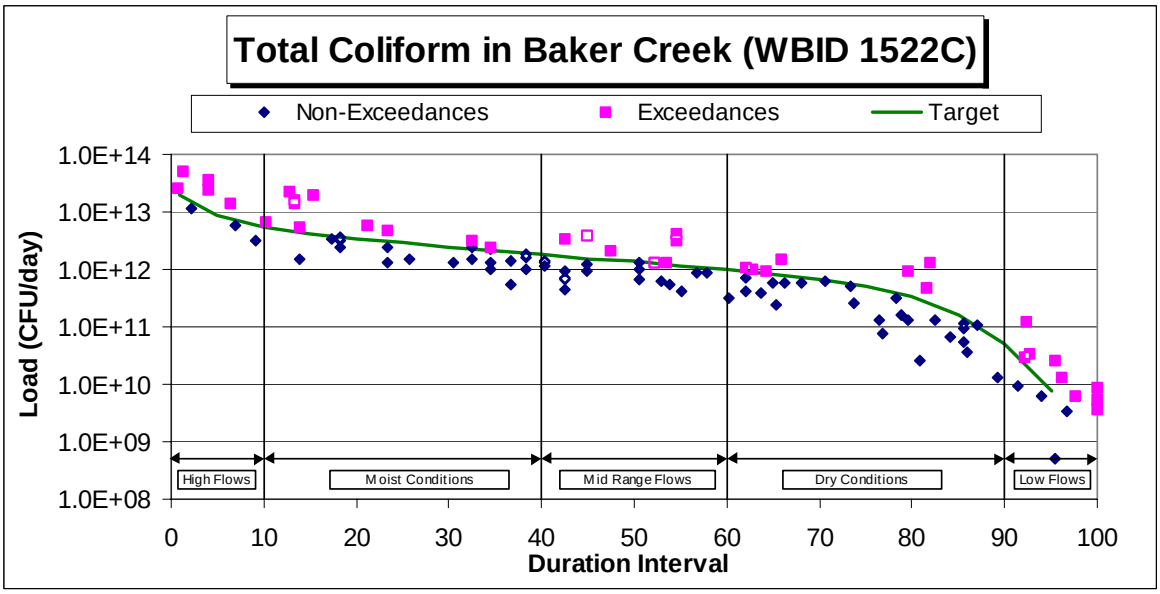


Figure 5.4. Load Duration Curve for Total Coliform in WBID 1522C



Fecal and Total Coliform Reduction Calculation

To estimate the existing load for a given flow condition, a regression analysis was performed to determine an equation that best represented the relationship between flow and fecal coliform loading. However, using the regression line **in Figure 5.3 and 5.4** would have resulted in negative load reductions for portions of the flow record because the regression line fell below the target line.

The TMDLs were therefore calculated using the flow zone method, which separates the flow according to high, moist, mid-range, dry, and low conditions shown in **Figure 5.3 and 5.4.** A detailed description of flow zones, and the procedures for the following calculations, can be found in the TMDL report for Gap Creek (Gao & Petrus, 2004). Based on the available information, and best professional judgement (BPJ) as to where the majority of exceedances occur, the required fecal coliform reduction was calculated as the median of the percent reductions for the flow zone from the 40^{th} to the 90^{th} percentile, and the required total coliform reduction was the median percent reduction for the flow zone from the 10^{th} to the 90^{th} percentile.

Table 5.2 shows the TMDL loads for fecal and total coliform, which were calculated as the median load for each flow zone. **Table 5.3 and 5.4** show the existing loading for fecal and total coliform, and the needed load reductions based on the flow condition.

Table 5.2 Fecal and Total Colifom TMDL Loads

Flow Rank (%)	cfs	Fecal Coliform TMDL Load (counts/day)	Total Coliform TMDL Load (counts/day)
0.023	1108.226	1.08455E+13	6.50729E+13
0.100	804.019	7.86841E+12	4.72105E+13
0.274	583.630	5.71161E+12	3.42697E+13
1	338.994	3.31752E+12	1.99051E+13
5	146.209	1.43086E+12	8.58515E+12
10	95.354	9.33168E+11	5.59901E+12
15	72.045	7.05060E+11	4.23036E+12
20	59.331	5.80638E+11	3.48383E+12
25	48.736	4.76953E+11	2.86172E+12
30	42.380	4.14741E+11	2.48845E+12
35	36.023	3.52530E+11	2.11518E+12
40	31.785	3.11056E+11	1.86634E+12
45	25.428	2.48845E+11	1.49307E+12
50	23.309	2.28108E+11	1.36865E+12
55	19.283	1.88707E+11	1.13224E+12
60	16.528	1.61749E+11	9.70495E+11
65	13.773	1.34791E+11	8.08746E+11
70	11.231	1.09906E+11	6.59439E+11
75	8.476	8.29483E+10	4.97690E+11
80	5.721	5.59901E+10	3.35941E+11
85	2.755	2.69582E+10	1.61749E+11
90	0.848	8.29483E+09	4.97690E+10
95	0.127	1.24422E+09	7.46535E+09
99	0.021	2.07371E+08	1.24422E+09
100	0.021	2.07371E+08	1.24422E+09
Median for flow zone		**1.34791E+11**	**1.36865E+12**

Table 5.3 Fecal Coliform Existing Loading and Needed Load Reductions for the BPJ's flow condition

Flow Rank (%)	Fecal Coliform (CFU/100mL)	Existing Fecal Coliform Load (CFU/day)	Allowable Load (CFU/day)	Percent Load Reduction (%)
82.5	700	7.25798E+10	4.14741E+10	42.9
72.8	490	1.16853E+11	9.53905E+10	18.4
70.6	780	2.10274E+11	1.07833E+11	48.7
64.2	600	2.11518E+11	1.41012E+11	33.3
62.1	740	2.83891E+11	1.53454E+11	45.9
54.7	830	3.95871E+11	1.90781E+11	51.8
54.5	1460	7.0392E+11	1.92855E+11	72.6
53.5	560	2.78706E+11	1.99076E+11	28.6
52.9	490	2.48949E+11	2.03223E+11	18.4
52.2	420	2.17739E+11	2.07371E+11	4.8
50.6	500	2.85135E+11	2.28108E+11	20.0
47.4	2000	1.24422E+12	2.48845E+11	80.0
44.9	1120	7.54829E+11	2.69582E+11	64.3
42.5	2700	1.95965E+12	2.90319E+11	85.2
40.4	500	3.8882E+11	3.11056E+11	20.0
Median		**2.83891E+11**		**42.9**

Table 5.4 Total Coliform Existing Loading and Needed Load Reductions for the BPJ's flow condition.

Flow Rank (%)	Total Coliform (CFU/100mL)	Existing Total Coliform Load (CFU/day)	Allowable Load (CFU/day)	Percent Load Reduction (%)
81.9	11200	1.2774E+12	2.73729E+11	78.6
81.6	4100	4.88876E+11	2.86172E+11	41.5
79.6	6200	9.32131E+11	3.60825E+11	61.3
65.8	4500	1.49307E+12	7.96304E+11	46.7
64.2	2700	9.51832E+11	8.46073E+11	11.1
62.8	2600	9.70495E+11	8.95842E+11	7.7
62.1	2700	1.03582E+12	9.20726E+11	11.1
54.5	8600	4.14638E+12	1.15713E+12	72.1
54.5	6500	3.13389E+12	1.15713E+12	63.1
53.5	2600	1.29399E+12	1.19446E+12	7.7
52.2	2600	1.34791E+12	1.24422E+12	7.7
52.2	2600	1.34791E+12	1.24422E+12	7.7
47.4	3500	2.17739E+12	1.49307E+12	31.4
44.9	5600	3.77415E+12	1.61749E+12	57.1
44.9	5600	3.77415E+12	1.61749E+12	57.1
42.5	4700	3.41125E+12	1.74191E+12	48.9
34.5	2500	2.33292E+12	2.2396E+12	4.0
32.5	3300	3.25054E+12	2.36403E+12	27.3
23.4	3700	4.79545E+12	3.11056E+12	35.1
21.2	4100	5.73898E+12	3.35941E+12	41.5
15.3	11500	2.02705E+13	4.23036E+12	79.1
13.8	2800	5.3709E+12	4.60363E+12	14.3
13.3	8100	1.59572E+13	4.72805E+12	70.4
13.3	7200	1.41842E+13	4.72805E+12	66.7
12.7	11300	2.28471E+13	4.85247E+12	78.8
10.3	2800	6.53218E+12	5.59901E+12	14.3
Median		**3.19221E+12**		**41.5**

Chapter 6: DETERMINATION OF THE TMDL

6.1 Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating acceptable loads among all of the known pollutant sources in a watershed so that appropriate control measures can be implemented and water quality standards achieved. A TMDL is expressed as the sum of all point source loads (Waste Load Allocations, or WLAs), nonpoint source loads (Load Allocations, or LAs), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\textbf{TMDL} = \sum \textbf{WLAs} + \sum \textbf{LAs} + \textbf{MOS}$$

As discussed earlier, the WLA is broken out into separate subcategories for wastewater discharges and stormwater discharges regulated under the NPDES Program:

$$\textbf{TMDL} \cong \sum \textbf{WLAs}_{\textbf{wastewater}} + \sum \textbf{WLAs}_{\textbf{NPDES Stormwater}} + \sum \textbf{LAs} + \textbf{MOS}$$

It should be noted that the various components of the revised TMDL equation may not sum up to the value of the TMDL because a) the WLA for NPDES stormwater is typically based on the percent reduction needed for nonpoint sources and is also accounted for within the LA, and b) TMDL components can be expressed in different terms (for example, the WLA for stormwater is typically expressed as a percent reduction, and the WLA for wastewater is typically expressed as mass per day).

WLAs for stormwater discharges are typically expressed as “percent reduction” because it is very difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources. Because stormwater discharges cannot be centrally collected, monitored, and treated, they are not subject to the same types of effluent limitations as wastewater facilities, and instead are required to meet a performance standard of providing treatment to the “maximum extent practical” through the implementation of BMPs.

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or **other appropriate measure**. TMDLs for the WBID 1522C is expressed in terms of percent reduction and represent the maximum daily fecal and total coliform load the river segment can assimilate and maintain the fecal coliform and total coliform criteria **(Table 6.1).** The numbers of TMDL and LA in Table 6.1 were obtained from the highlighted numbers in Tables 5.2 and 5.5.

Table 6.1. TMDL Components for fecal and total coliform.

WBID	Parameter	TMDL (colonies/day)	WLA		LA (Percent Reduction)†	MOS
			Wastewater (colonies/day)	NPDES Stormwater		
1552C	Fecal Coliform	1.35E+11	~~8.72E+09~~N/A	42.9%	42.9%	Implicit
1552C	Total Coliform	1.37E+12	N/A	41.5%	41.5 %	Implicit

6.2 Load Allocation (LA)

Based on a loading duration curve approach similar to that developed by Kansas (Stiles, 2002), a fecal coliform reduction of 42.9% and a total coliform reduction of 41.5% is needed from nonpoint sources.

6.3 Wasteload Allocation (WLA)

6.3.1 NPDES Stormwater Discharges

The WLA for stormwater discharges with an MS4 permit is a 42.9 percent reduction for fecal coliform and a 41.5 percent reduction for total coliform. It should be noted that any MS4 permittee will only be responsible for reducing the loads associated with stormwater outfalls that it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction

6.4 Margin of Safety (MOS)

Consistent with the recommendations of the Allocation Technical Advisory Committee (FDEP, February 2001), an implicit margin of safety (MOS) was used in the development of this TMDL. An implicit MOS was included in the TMDL by not allowing any exceedances of state criteria (400 cfu/day for fecal coliform and 2400 cfu/day for total coliform). In addition, 400 counts/100 ml of fecal coliform was used as the water quality target instead of setting the criteria as that no more than 10% of the samples exceed 400 counts/100 ml. An implicit MOS was provided by the conservative decisions associated with a number of modeling assumptions and the development of assimilative capacity using the load duration method, which only focuses on exceedances. An additional MOS was included in the TMDL by not allowing any exceedances of state criterion, even though intermittent natural exceedances of the criterion would be expected and would be taken into account when determining impairment. The implicit MOS is appropriate as existing loads are based on in-stream fecal coliform and total coliform measurements. These measurements include decay processes occuring in-stream and do not represent the maximum load that can be applied to the land and transported to the stream during a rain event.

Chapter 7: NEXT STEPS: IMPLEMENTATION PLAN DEVELOPMENT AND BEYOND

7.1 Basin Management Action Plan

Following the adoption of this TMDL by rule, the next step in the TMDL process is to develop an implementation plan for the TMDL, which will be a component of the Basin Management Action Plan (BMAP) for the Hillsborough Basin. This document will be developed over the next year in cooperation with local stakeholders and will attempt to reach consensus on more detailed allocations and on how load reductions will be accomplished. The BMAP will include the following:

- Appropriate allocations among the affected parties,
- A description of the load reduction activities to be undertaken,
- Timetables for project implementation and completion,
- Funding mechanisms that may be utilized,
- Any applicable signed agreement,
- Local ordinances defining actions to be taken or prohibited,
- Local water quality standards, permits, or load limitation agreements, and
- Monitoring and follow-up measures.

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Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as authorized in Chapter 403, F.S., was established as a technology-based program that relies on the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Chapter 62-40, F.A.C.

The rule requires the state's water management districts (WMDs) to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a SWIM plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, stormwater PLRGs have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka. No PLRG has been developed for Newnans Lake at the time this study was conducted.

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES stormwater permitting program to designate certain stormwater discharges as "point sources" of pollution. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific Standard Industrial Classification (SIC) codes, construction sites disturbing five or more acres of land, and master drainage systems of local governments with a population above 100,000, which are better known as municipal separate storm sewer systems (MS4s). However, because the master drainage systems of most local governments in Florida are interconnected, the EPA has implemented Phase 1 of the MS4 permitting program on a countywide basis, which brings in all cities (incorporated areas), Chapter 298 urban water control districts, and the Florida Department of Transportation throughout the fifteen counties meeting the population criteria.

An important difference between the federal and state stormwater permitting programs is that the federal program covers both new and existing discharges, while the state program focuses on new discharges. Additionally, Phase 2 of the NPDES Program will expand the need for these permits to construction sites between one and five acres, and to local governments with as few as 10,000 people. These revised rules require that these additional activities obtain permits by 2003. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility similar to other point sources of pollution, such as domestic and industrial wastewater discharges. The Department recently accepted delegation from the EPA for the stormwater part of the NPDES Program. It should be noted that most MS4 permits issued in Florida include a re-opener clause that allows permit revisions to implement TMDLs once they are formally adopted by rule.

Appendix B Summary of Fecal Coliform Monitoring Data

Unit: MPN/100 ml

Station ID	Date	Time	Result
21FLHILL107	1/20/1999	1312	**780**
21FLHILL107	2/17/1999	1105	340
21FLHILL107	3/17/1999	1136	**1460**
21FLHILL107	4/21/1999	1315	20
21FLHILL107	5/19/1999	1220	60
21FLHILL107	6/16/1999	1232	240
21FLHILL107	7/21/1999	1325	240
21FLHILL107	8/18/1999	1155	380
21FLHILL107	10/13/1999	1200	80
21FLHILL107	11/17/1999	1202	20
21FLHILL107	12/15/1999	1323	120
21FLHILL107	1/19/2000	1245	260
21FLHILL107	2/16/2000	1340	100
21FLHILL107	3/15/2000	1230	20
21FLHILL107	4/19/2000	1305	20
21FLHILL107	5/16/2000	1140	20
21FLHILL107	6/21/2000	1340	380
21FLHILL107	7/19/2000	1220	100
21FLHILL107	8/16/2000	1334	320
21FLHILL107	9/20/2000	1335	**500**
21FLHILL107	10/11/2000	1336	60
21FLHILL107	11/15/2000	1323	40
21FLHILL107	12/13/2000	1300	20
21FLHILL107	1/17/2001	1300	40
21FLHILL107	2/21/2001	1317	200
21FLHILL107	3/21/2001	1150	**520**
21FLHILL107	4/18/2001	1433	20
21FLHILL107	5/16/2001	1305	40
21FLHILL107	6/20/2001	1140	20
21FLHILL107	7/25/2001	1302	260
21FLHILL107	8/22/2001	1504	40
21FLHILL107	9/19/2001	1355	100
21FLHILL107	10/17/2001	1253	180
21FLHILL107	11/14/2001	1356	240
21FLHILL107	12/12/2001	1335	20
21FLHILL107	1/16/2002	1359	**490**
21FLHILL107	1/16/2002	1359	**490**
21FLHILL107	2/20/2002	1324	**490**
21FLHILL107	2/20/2002	1324	**490**
21FLHILL107	3/20/2002	1400	30
21FLHILL107	3/20/2002	1400	30
21FLHILL107	4/17/2002	1312	280
21FLHILL107	4/17/2002	1312	280
21FLHILL107	5/15/2002	1307	20

21FLHILL107	5/15/2002	1307	20
21FLHILL107	6/19/2002	1140	**830**
21FLHILL107	6/19/2002	1140	**830**
21FLHILL107	7/24/2002	1522	250
21FLHILL107	7/24/2002	1522	250
21FLHILL107	8/21/2002	1347	**510**
21FLHILL107	8/21/2002	1347	**510**
21FLHILL107	9/18/2002	1326	180
21FLHILL107	9/18/2002	1326	180
21FLHILL107	10/16/2002	1315	290
21FLHILL107	10/16/2002	1315	290
21FLHILL107	11/20/2002	1341	90
21FLHILL107	11/20/2002	1341	90
21FLHILL107	12/11/2002	1345	**960**
21FLHILL107	12/11/2002	1345	**960**
21FLHILL24030034	1/23/1991	1040	**1200**
21FLHILL24030034	2/26/1991	1015	**1200**
21FLHILL24030034	3/27/1991	1005	**500**
21FLHILL24030034	4/24/1991	1015	**900**
21FLHILL24030034	5/22/1991	1010	**700**
21FLHILL24030034	6/26/1991	1055	**1000**
21FLHILL24030034	7/31/1991	1000	**2700**
21FLHILL24030034	8/28/1991	1000	**1800**
21FLHILL24030034	9/25/1991	1015	**1400**
21FLHILL24030034	10/23/1991	1020	**1800**
21FLHILL24030034	11/20/1991	1000	**1400**
21FLHILL24030034	12/11/1991	1030	**1000**
21FLHILL24030034	1/29/1992	1045	**900**
21FLHILL24030034	2/26/1992	1120	**3200**
21FLHILL24030034	3/25/1992	950	**1100**
21FLHILL24030034	4/22/1992	1040	**800**
21FLHILL24030034	5/27/1992	1200	**700**
21FLHILL24030034	6/24/1992	1005	100
21FLHILL24030034	7/29/1992	1002	100
21FLHILL24030034	8/26/1992	1020	100
21FLHILL24030034	9/22/1992	1100	**1000**
21FLHILL24030034	10/28/1992	1025	**500**
21FLHILL24030034	11/18/1992	1000	300
21FLHILL24030034	12/16/1992	930	**2700**
21FLHILL24030034	1/20/1993	950	200
21FLHILL24030034	2/17/1993	1020	100
21FLHILL24030034	3/17/1993	940	100
21FLHILL24030034	4/21/1993	1000	100
21FLHILL24030034	5/19/1993	925	**400**
21FLHILL24030034	6/16/1993	1030	**400**
21FLHILL24030034	7/21/1993	1010	**600**
21FLHILL24030034	8/18/1993	1000	**1120**
21FLHILL24030034	8/18/1993	1000	**1120**
21FLHILL24030034	9/15/1993	1042	240
21FLHILL24030034	9/15/1993	1042	240
21FLHILL24030034	10/20/1993	1010	**560**

21FLHILL24030034	11/17/1993	1010	**560**
21FLHILL24030034	12/15/1993	1020	**740**
21FLHILL24030034	1/26/1994	1020	180
21FLHILL24030034	2/23/1994	935	380
21FLHILL24030034	3/23/1994	1018	260
21FLHILL24030034	4/27/1994	1210	220
21FLHILL24030034	5/25/1994	1015	80
21FLHILL24030034	6/22/1994	1130	**960**
21FLHILL24030034	7/27/1994	1340	**1000**
21FLHILL24030034	8/24/1994	1150	320
21FLHILL24030034	9/28/1994	1150	380
21FLHILL24030034	10/26/1994	1150	160
21FLHILL24030034	11/30/1994	1210	300
21FLHILL24030034	12/14/1994	1209	**460**
21FLHILL24030034	1/25/1995	1235	360
21FLHILL24030034	2/22/1995	1235	120
21FLHILL24030034	3/22/1995	1200	80
21FLHILL24030034	4/26/1995	1245	160
21FLHILL24030034	5/24/1995	1213	140
21FLHILL24030034	6/28/1995	1201	80
21FLHILL24030034	7/26/1995	1135	**560**
21FLHILL24030034	8/23/1995	1159	280
21FLHILL24030034	9/27/1995	1229	260
21FLHILL24030034	10/25/1995	1335	100
21FLHILL24030034	11/29/1995	1235	**2000**
21FLHILL24030034	12/13/1995	1307	**500**
21FLHILL24030034	1/24/1996	1209	160
21FLHILL24030034	2/21/1996	1250	380
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21FLHILL24030034	6/19/1996	1420	100
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21FLHILL24030034	2/19/1997	1323	20
21FLHILL24030034	3/19/1997	1306	60
21FLHILL24030034	4/16/1997	1246	**440**
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21FLHILL24030034	6/18/1997	1246	60
21FLHILL24030034	7/23/1997	1252	60
21FLHILL24030034	8/20/1997	1230	200
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21FLHILL24030034	11/19/1997	1300	100
21FLHILL24030034	12/10/1997	1200	200
21FLHILL24030034	1/21/1998	1235	140

21FLHILL24030034	2/18/1998	1245	**540**
21FLHILL24030034	3/18/1998	1250	180
21FLHILL24030034	4/22/1998	1235	60
21FLHILL24030034	5/20/1998	1240	200
21FLHILL24030034	6/17/1998	1230	60
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21FLHILL24030034	9/16/1998	1230	240
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21FLHILL24030034	11/18/1998	1315	180
21FLHILL24030034	12/9/1998	1120	340
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112WRD 02303205	9/26/1994	1510	166
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21FLHILL107	4/19/2000	1305	120
21FLHILL107	5/16/2000	1140	140
21FLHILL107	1/19/2000	1245	220
21FLHILL107	2/16/2000	1340	140
21FLHILL107	12/13/2000	1300	60
21FLHILL107	5/19/1999	1220	300
21FLHILL107	10/11/2000	1336	120
21FLHILL107	2/17/1999	1105	260
21FLHILL107	3/17/1999	1136	**440**
21FLHILL107	9/20/2000	1335	**5800**
21FLHILL107	6/16/1999	1232	40
21FLHILL107	11/15/2000	1323	220
21FLHILL107	7/21/1999	1325	320
21FLHILL107	8/16/2000	1334	**1100**
21FLHILL107	4/21/1999	1315	**400**
21FLHILL107	8/18/1999	1155	**760**
21FLHILL107	7/19/2000	1220	**600**
21FLHILL107	10/13/1999	1200	**400**
21FLHILL107	12/15/1999	1323	120
21FLHILL107	6/21/2000	1340	**2360**
21FLHILL107	11/17/1999	1202	140
21FLHILL107	1/20/1999	1312	**720**
21FLHILL24030034	12/15/1993	1020	**580**
21FLHILL24030034	5/27/1992	1200	300
21FLHILL24030034	8/26/1992	1020	300
21FLHILL24030034	8/23/1995	1159	**900**
21FLHILL24030034	5/19/1993	925	**900**
21FLHILL24030034	10/26/1994	1150	**560**
21FLHILL24030034	1/29/1992	1045	100
21FLHILL24030034	5/24/1995	1213	300
21FLHILL24030034	8/24/1994	1150	280
21FLHILL24030034	7/29/1992	1002	**800**
21FLHILL24030034	6/24/1992	1005	**1800**
21FLHILL24030034	4/26/1995	1245	**1100**

21FLHILL24030034	4/22/1992	1040	**600**
21FLHILL24030034	2/21/1996	1250	320
21FLHILL24030034	1/26/1994	1020	**460**
21FLHILL24030034	11/17/1993	1010	380
21FLHILL24030034	2/26/1992	1120	**10000**
21FLHILL24030034	7/26/1995	1135	**1440**
21FLHILL24030034	3/25/1992	950	**400**
21FLHILL24030034	8/18/1993	1000	**880**
21FLHILL24030034	12/13/1995	1307	200
21FLHILL24030034	11/18/1992	1000	**900**
21FLHILL24030034	6/16/1993	1030	**500**
21FLHILL24030034	1/25/1995	1235	**3620**
21FLHILL24030034	9/15/1993	1042	**440**
21FLHILL24030034	10/28/1992	1025	**400**
21FLHILL24030034	6/22/1994	1130	**1080**
21FLHILL24030034	7/27/1994	1340	**2000**
21FLHILL24030034	9/15/1993	1042	**440**
21FLHILL24030034	11/30/1994	1210	**760**
21FLHILL24030034	11/29/1995	1235	**2680**
21FLHILL24030034	2/22/1995	1235	300
21FLHILL24030034	1/20/1993	950	200
21FLHILL24030034	10/20/1993	1010	**800**
21FLHILL24030034	9/27/1995	1229	**500**
21FLHILL24030034	12/14/1994	1209	**860**
21FLHILL24030034	6/28/1995	1201	**580**
21FLHILL24030034	3/17/1993	940	**400**
21FLHILL24030034	3/23/1994	1018	380
21FLHILL24030034	2/17/1993	1020	**800**
21FLHILL24030034	10/25/1995	1335	240
21FLHILL24030034	9/28/1994	1150	**640**
21FLHILL24030034	5/25/1994	1015	340
21FLHILL24030034	2/23/1994	935	460
21FLHILL24030034	12/16/1992	930	**1700**
21FLHILL24030034	4/27/1994	1210	380
21FLHILL24030034	4/21/1993	1000	**1000**
21FLHILL24030034	3/22/1995	1200	200
21FLHILL24030034	1/24/1996	1209	340
21FLHILL24030034	8/18/1993	1000	**880**
21FLHILL24030034	9/22/1992	1100	**2700**
21FLHILL24030034	7/21/1993	1010	**1300**
21FLHILL24030034	7/23/1997	1252	**1500**
21FLHILL24030034	3/20/1996	1300	340
21FLHILL24030034	11/20/1996	1312	**760**
21FLHILL24030034	6/18/1997	1246	**780**
21FLHILL24030034	11/19/1997	1300	380
21FLHILL24030034	1/21/1998	1235	180
21FLHILL24030034	5/15/1996	1540	**840**
21FLHILL24030034	2/18/1998	1245	**660**
21FLHILL24030034	1/23/1991	1040	**1000**
21FLHILL24030034	10/16/1996	1156	**840**
21FLHILL24030034	8/26/1998	1238	**500**

21FLHILL24030034	9/25/1996	1252	**680**
21FLHILL24030034	3/27/1991	1005	300
21FLHILL24030034	8/28/1991	1000	**1100**
21FLHILL24030034	11/20/1991	1000	**900**
21FLHILL24030034	4/22/1998	1235	**1060**
21FLHILL24030034	9/16/1998	1230	**460**
21FLHILL24030034	4/24/1991	1015	**1000**
21FLHILL24030034	8/21/1996	1248	**400**
21FLHILL24030034	7/17/1996	1305	**500**
21FLHILL24030034	7/22/1998	1223	**920**
21FLHILL24030034	4/16/1997	1246	**1960**
21FLHILL24030034	7/31/1991	1000	**5700**
21FLHILL24030034	12/11/1996	1400	**1080**
21FLHILL24030034	2/26/1991	1015	200
21FLHILL24030034	11/18/1998	1315	220
21FLHILL24030034	6/19/1996	1420	**560**
21FLHILL24030034	9/17/1997	1256	**1460**
21FLHILL24030034	5/20/1998	1240	**1300**
21FLHILL24030034	12/11/1991	1030	**400**
21FLHILL24030034	8/20/1997	1230	**800**
21FLHILL24030034	3/19/1997	1306	**1400**
21FLHILL24030034	9/25/1991	1015	**800**
21FLHILL24030034	6/26/1991	1055	**400**
21FLHILL24030034	5/22/1991	1010	**500**
21FLHILL24030034	3/18/1998	1250	220
21FLHILL24030034	2/19/1997	1323	120
21FLHILL24030034	10/15/1997	1338	120
21FLHILL24030034	10/23/1991	1020	**600**
21FLHILL24030034	4/17/1996	1340	**1360**
21FLHILL24030034	12/9/1998	1120	**440**
21FLHILL24030034	1/22/1997	1250	140
21FLHILL24030034	10/21/1998	1136	**420**
21FLHILL24030034	12/10/1997	1200	**440**
21FLHILL24030034	5/21/1997	1340	320
21FLHILL24030034	6/17/1998	1230	80

Note: Bold numbers represent the measurements that exceeded the water quality criterion.

Appendix C Summary of Total Coliform Monitoring Data

Unit: MPN/100 ml

Station ID	Date	Time	Result
21FLHILL107	1/20/1999	1312	2300
21FLHILL107	2/17/1999	1105	1100
21FLHILL107	3/17/1999	1136	**6500**
21FLHILL107	4/21/1999	1315	800
21FLHILL107	5/19/1999	1220	200
21FLHILL107	6/16/1999	1232	1000
21FLHILL107	7/21/1999	1325	1100
21FLHILL107	8/18/1999	1155	**4100**
21FLHILL107	10/13/1999	1200	900
21FLHILL107	11/17/1999	1202	800
21FLHILL107	12/15/1999	1323	400
21FLHILL107	1/19/2000	1245	**4100**
21FLHILL107	2/16/2000	1340	2300
21FLHILL107	3/15/2000	1230	**5900**
21FLHILL107	4/19/2000	1305	**10600**
21FLHILL107	5/16/2000	1140	**16800**
21FLHILL107	7/19/2000	1220	**8600**
21FLHILL107	8/16/2000	1334	**11300**
21FLHILL107	10/11/2000	1336	**6200**
21FLHILL107	11/15/2000	1323	**7000**
21FLHILL107	12/13/2000	1300	**6200**
21FLHILL107	1/17/2001	1300	200
21FLHILL107	4/18/2001	1433	**4200**
21FLHILL107	5/16/2001	1305	**13600**
21FLHILL107	6/20/2001	1140	**9800**
21FLHILL107	7/25/2001	1302	**11500**
21FLHILL107	8/22/2001	1504	**7200**
21FLHILL107	9/19/2001	1355	**8900**
21FLHILL107	10/17/2001	1253	**4500**
21FLHILL107	11/14/2001	1356	**11200**
21FLHILL107	12/12/2001	1335	**3100**
21FLHILL24030034	1/23/1991	1040	1800
21FLHILL24030034	2/26/1991	1015	2100
21FLHILL24030034	3/27/1991	1005	600
21FLHILL24030034	4/24/1991	1015	1200
21FLHILL24030034	5/22/1991	1010	1300
21FLHILL24030034	6/26/1991	1055	1700
21FLHILL24030034	7/31/1991	1000	**2600**
21FLHILL24030034	8/28/1991	1000	1800
21FLHILL24030034	9/25/1991	1015	1900
21FLHILL24030034	10/23/1991	1020	**2600**
21FLHILL24030034	11/20/1991	1000	**2600**
21FLHILL24030034	12/11/1991	1030	1300
21FLHILL24030034	1/29/1992	1045	1600
21FLHILL24030034	2/26/1992	1120	**20000**
21FLHILL24030034	3/25/1992	950	1800

21FLHILL24030034	4/22/1992	1040	1400
21FLHILL24030034	5/27/1992	1200	1300
21FLHILL24030034	6/24/1992	1005	**2200**
21FLHILL24030034	7/29/1992	1002	1300
21FLHILL24030034	8/26/1992	1020	2100
21FLHILL24030034	9/22/1992	1100	**5700**
21FLHILL24030034	10/28/1992	1025	1800
21FLHILL24030034	11/18/1992	1000	1700
21FLHILL24030034	12/16/1992	930	**4700**
21FLHILL24030034	1/20/1993	950	**2400**
21FLHILL24030034	2/17/1993	1020	**2500**
21FLHILL24030034	3/17/1993	940	**3700**
21FLHILL24030034	4/21/1993	1000	**3300**
21FLHILL24030034	5/19/1993	925	2000
21FLHILL24030034	6/16/1993	1030	1900
21FLHILL24030034	7/21/1993	1010	**2700**
21FLHILL24030034	8/18/1993	1000	**5600**
21FLHILL24030034	8/18/1993	1000	**5600**
21FLHILL24030034	9/15/1993	1042	2000
21FLHILL24030034	9/15/1993	1042	2000
21FLHILL24030034	10/20/1993	1010	2200
21FLHILL24030034	11/17/1993	1010	**2600**
21FLHILL24030034	12/15/1993	1020	1800
21FLHILL24030034	1/26/1994	1020	600
21FLHILL24030034	2/23/1994	935	**2600**
21FLHILL24030034	3/23/1994	1018	1100
21FLHILL24030034	4/27/1994	1210	1000
21FLHILL24030034	5/25/1994	1015	700
21FLHILL24030034	6/22/1994	1130	2000
21FLHILL24030034	7/27/1994	1340	**8100**
21FLHILL24030034	8/24/1994	1150	**2800**
21FLHILL24030034	9/28/1994	1150	**2800**
21FLHILL24030034	10/26/1994	1150	1000
21FLHILL24030034	11/30/1994	1210	1300
21FLHILL24030034	12/14/1994	1209	1300
21FLHILL24030034	1/25/1995	1235	1300
21FLHILL24030034	2/22/1995	1235	1800
21FLHILL24030034	3/22/1995	1200	1200
21FLHILL24030034	4/26/1995	1245	1100
21FLHILL24030034	5/24/1995	1213	800
21FLHILL24030034	6/28/1995	1201	**2800**
21FLHILL24030034	7/26/1995	1135	**4400**
21FLHILL24030034	8/23/1995	1159	1700
21FLHILL24030034	9/27/1995	1229	2000
21FLHILL24030034	10/25/1995	1335	1300
21FLHILL24030034	11/29/1995	1235	**3500**
21FLHILL24030034	12/13/1995	1307	2300
21FLHILL24030034	1/24/1996	1209	1300
21FLHILL24030034	2/21/1996	1250	1600
21FLHILL24030034	3/20/1996	1300	600
21FLHILL24030034	4/17/1996	1340	**2400**

21FLHILL24030034	5/15/1996	1540	1200
21FLHILL24030034	6/19/1996	1420	1500
21FLHILL24030034	7/17/1996	1305	1500
21FLHILL24030034	8/21/1996	1248	1900
21FLHILL24030034	9/25/1996	1252	**2600**
21FLHILL24030034	10/16/1996	1156	900
21FLHILL24030034	11/20/1996	1312	**2600**
21FLHILL24030034	12/11/1996	1400	1000
21FLHILL24030034	1/22/1997	1250	700
21FLHILL24030034	2/19/1997	1323	1800
21FLHILL24030034	3/19/1997	1306	1700
21FLHILL24030034	4/16/1997	1246	2200
21FLHILL24030034	5/21/1997	1340	1200
21FLHILL24030034	6/18/1997	1246	500
21FLHILL24030034	7/23/1997	1252	1900
21FLHILL24030034	8/20/1997	1230	1700
21FLHILL24030034	9/17/1997	1256	600
21FLHILL24030034	10/15/1997	1338	1400
21FLHILL24030034	11/19/1997	1300	800
21FLHILL24030034	12/10/1997	1200	1300
21FLHILL24030034	1/21/1998	1235	1500
21FLHILL24030034	2/18/1998	1245	**6500**
21FLHILL24030034	3/18/1998	1250	1800
21FLHILL24030034	4/22/1998	1235	**2700**
21FLHILL24030034	5/20/1998	1240	1400
21FLHILL24030034	6/17/1998	1230	800
21FLHILL24030034	7/22/1998	1223	2100
21FLHILL24030034	8/26/1998	1238	**2400**
21FLHILL24030034	9/16/1998	1230	1200
21FLHILL24030034	10/21/1998	1136	1800
21FLHILL24030034	11/18/1998	1315	1100
21FLHILL24030034	12/9/1998	1120	900

Note: Bold numbers represent the measurements that exceeded the water quality criterion.

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